(12) UK Patent Application (19) GB (11) 2 202 641 (13) A

(43) Application published 28 Sep 1988

(21) Application No 8806648

(22) Date of filing 21 Mar 1988

(30) Priority data
(31) 62/070505 (32) 26 Mar 1987 (33) JP

(71) Applicant
Brother Kogyo Kabushiki Kaisha

(Incorporated in Japan)

No 35 9-chome Horita-dori, Mizuho-ku,
Nagoya, Japan

(72) Inventor
Jun Sakai

(74) Agent and/or Address for Service
Lloyd Wise Tregear & Co
Norman House, 105-109 Strand, London, WC2R 0AE

(51) INT CL'
G03C 5/24

(52) Domestic classification (Edition J):
G2C AX

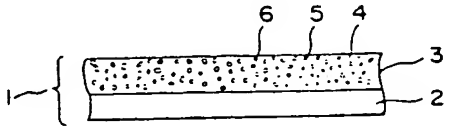
(56) Documents cited
GB A 2187298 GB A 2111232 GB 1013101
GB 0998011 GB 0921673

(58) Field of search
G2C
Selected US specifications from IPC sub-class
G03C

(54) Recording medium

(57) A recording medium 1 comprises a thermally fusible and transferable developing layer 3 including a binder 4, a developer 5 which reacts with a dye precursor released from microcapsules to generate a colour, and a low melting material 6 such as a wax. The recording medium may also contain the dye-precursor in photosensitive microcapsules so that an imagewise exposure and development or coloured image is produced (Fig 4). Alternatively, a separate material containing the microcapsules is exposed and then pressed into contact with the recording medium to form an image thereon (Fig 2). The recording medium may be used to form images on substrates such as paper or cloth which have not been specially treated by transferring layer 3 by heating onto the substrate either before or after an image has been formed in layer 3 (Figs 2-4).

FIG. 1



GB 2 202 641 A

2202641

FIG. 1

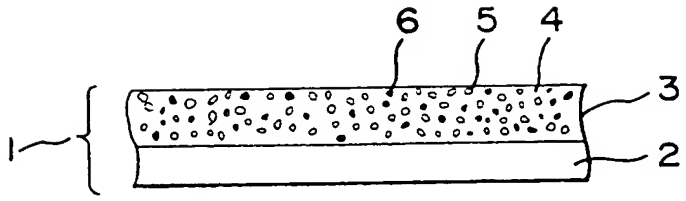
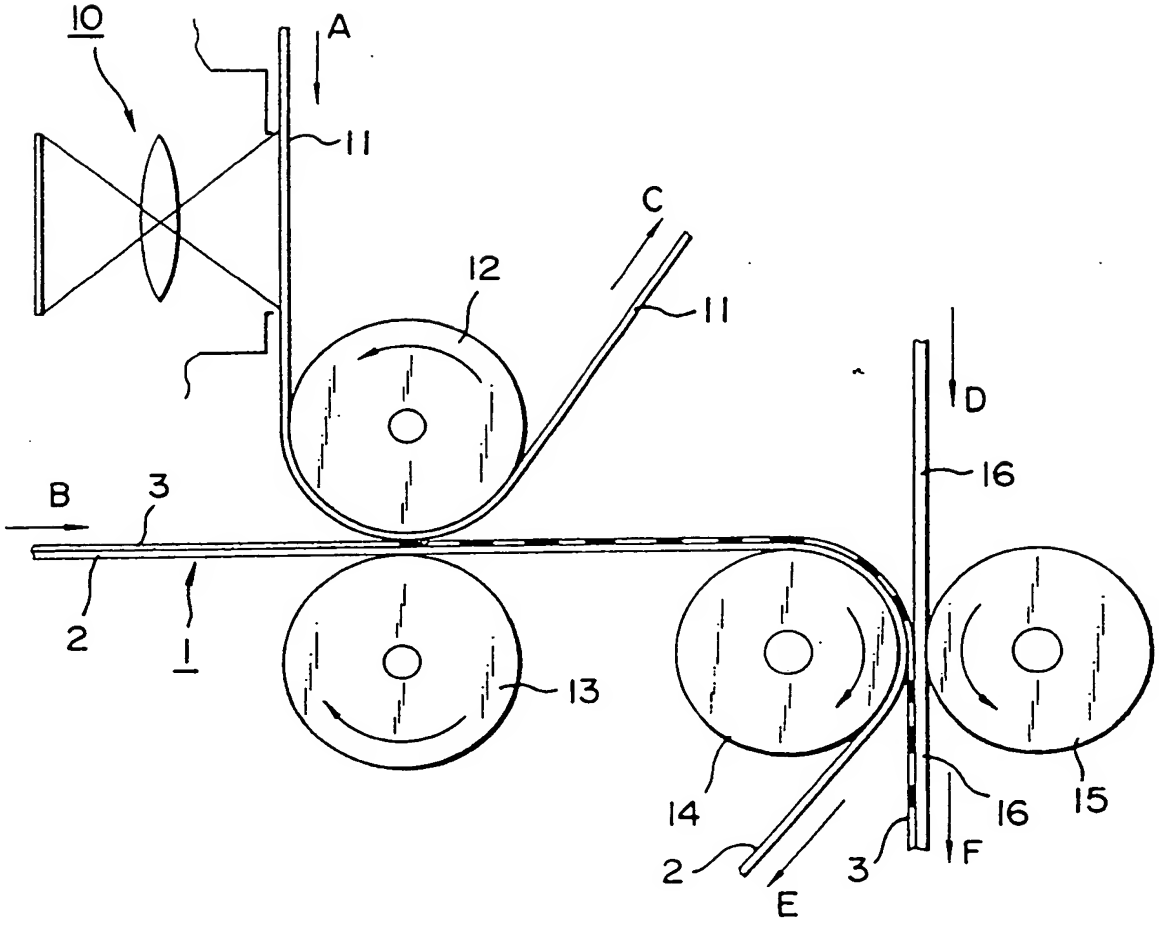


FIG. 2



2202641

FIG. 3

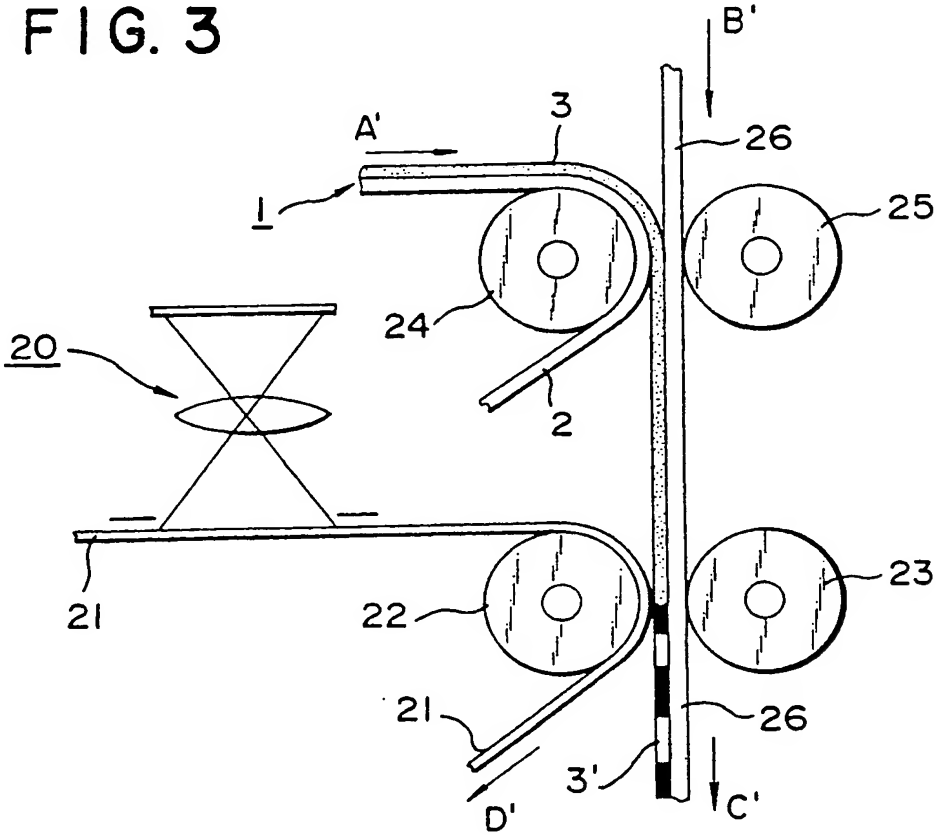
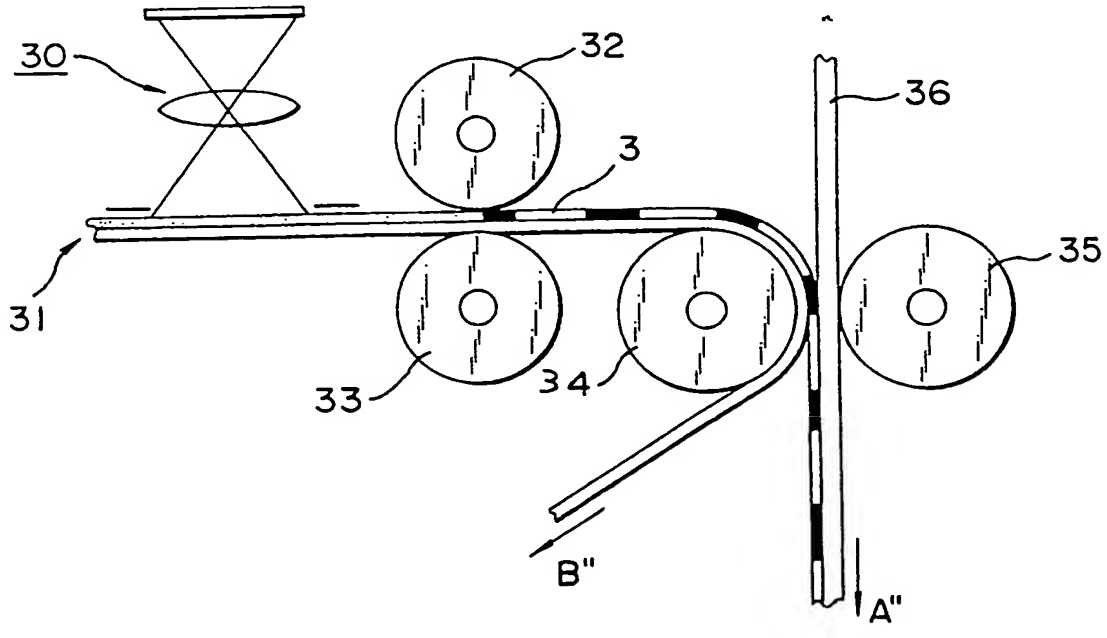


FIG. 4



2202641

RECORDING MEDIUM

This invention relates to recording media.

Known recording media for copying machines, printers, and so on, include specially processed recording sheets, such as pressure-sensitive recording sheets, thermo-sensitive recording sheets, photo-pressure sensitive recording sheets, etc, of either the so-called "self-contained" type or of the so-called "separate" type. The recording sheet of the self-contained type comprises a support such as paper, plastics film, or the like, coated with microcapsules and a developing layer. The microcapsules contain a dye precursor and have a mechanical hardness which change in accordance with externally applied information. The developing layer includes a developer which reacts with dye precursor selectively released from the microcapsules. In the case of recording media of the separate type, there are separate recording and developer sheets. The recording sheet has a support carrying microcapsules containing a dye precursor and the separately provided developer sheet has its own support on which is formed a developing layer containing a developer for reaction with the dye precursor. Acid materials are mainly used as the developer.

More particularly, in the case of a recording sheet of the self-contained type, after information has been externally applied so as to change the hardness of the microcapsules selectively to form a latent image, pressure is exerted onto the microcapsules so as to selectively rupture the microcapsules to make the ruptured microcapsules react with the developer carried on the same support, to thereby generate colours selectively and develop the latent image. Similarly, in the case of a recording system of the separate type, after information is externally applied so as to

selectively change the hardness of the microcapsules to form a latent image, the imaging sheet is pressed together with the separately prepared developer sheet superposed on the recording sheet so as to selectively rupture the microcapsules of reduced hardness, whereby the dye precursor released from the ruptured microcapsules reacts with the developer carried on the developer sheet, to thereby generate colours selectively and develop the latent image.

However, in both of these known systems there have been the disadvantages that the recording medium per se must be a specially processed one and also that the recording system can not be applied to ordinary paper, cloth, etc.

The present invention has been made from a consideration of these disadvantages of the prior art systems.

In accordance with the present invention there is provided a recording medium which comprises a thermally fusible and transferable developing layer including a developer adapted to react with a dye precursor to develop a colour. The recording medium of this invention may be either of the self-contained type or of the separate type; in the former the dye precursor is contained within microcapsules which are provided together with developing layer in the same recording medium, while in the latter the dye precursor-containing microcapsules are provided in a separate recording medium against which the recording medium carrying the developer is superposed in use.

In the recording medium according to the present invention, the developing layer is made to be thermally fusible and transferable. The recording medium can thus be used in a number of different ways. In one embodiment, after desired information eg letters, pictures or the like has been recorded on the recording

medium by any known method, the recording medium and a substrate which does not require to be specially prepared, for example ordinary paper or cloth, are superposed one on the other and are heated so that the developing layer carrying the image corresponding to the information is heat-transferred onto the substrate. The transferred image may be a latent image, which is then developed directly on the substrate material, or it may be a previously developed image. Alternatively, the developing layer may be heat-transferred onto a substrate eg of paper or cloth, by the procedure described, and then an image is developed in the developing layer, for example by pressure contact with an imaging sheet bearing a latent image.

Thus, the present invention provides a recording medium which enables desired information to be transferred to or recorded on a substrate such as ordinary paper or cloth which does not need to have been specially treated.

The present invention will now be described further with reference to the accompanying drawings, in which:

Fig. 1 is a schematic sectional view of a part of an embodiment of a recording medium according to the present invention, on a much enlarged scale to explain the structure thereof;

Figs. 2 and 3 are schematic views illustrating two different types of recording apparatus in which a recording medium of separate type in accordance with this invention may be used; and

Fig. 4 is a schematic view illustrating a recording medium apparatus in which a recording medium of self-contained type in accordance with this invention may be used.

Referring first to Fig. 1 there is shown a schematic view illustrating the structure of a recording

medium according to the present invention. In the embodiment illustrated, the recording medium 1 comprises a support 2 which is coated with a thermally fusible and transferable developing layer 3.

Paper, plastics, or any other suitable material may be used as the support 2. Examples of the material useful for forming the support 2 include plastics films of polyester, polyimide, polycarbonate, polysulfone, polyethersulfone, polyphenylene sulfide, polyether ketone, etc which have a heat resisting temperature not lower than 150°C; and paper such as condenser paper, glassine paper, etc.

The thermally fusible and transferable developing layer 3 is composed of a resin binder 4 having a relatively high melting point, a developer 5 and a colourless or light-coloured low-melting material 6, the developer 5 and the material 6 being dispersed in the resin binder 4. The developer 5 is not mixed in the low-melting material 6.

Suitably, the low melting material 6 has a melting point in a range of from 40°C to 100°C. Examples of materials which may be employed include: wax-like materials such as paraffin wax, microcrystalline wax, oxided paraffin wax, oxided micro-wax, candelilla wax, carnauba wax, bees wax, montan wax, ceresin wax, polyethylene wax, oxided polyethylene wax, castor wax, tallow hydrogenated oil, various kinds of fatty acid, lanolin, Japan wax, sorbitan stearate, sorbitan distearate, sorbitan parmitate, stearyl alcohol, polyamide wax, oleyl amide, stearyl amide, hydroxystearic acid, synthetic ester wax, synthetic metal-containing wax, polyoxyethylene oleyl ether, polyoxyethylene nonyl phenolether, etc; and low-melting thermoplastic resins such as petroleum resin, rosin, ester gum, keton resin, epoxy resin, ethylene-vinyl acetate copolymer resin, ethylene-α olefin copolymer resin, etc. The above low-

melting materials may be used singly or in a suitable mixture thereof. It is preferred that the overall melting point of substance or substances used should be a value within a range of from about 40°C to about 85°C.

Being fused at a relatively low temperature, the low-melting material 6 functions to enhance the flowability of the thermally fusible and transferable developing layer 3, to thereby improve the adhesion of the developing layer 3 onto a desired material, such as ordinary paper, cloth or the like, when the coloured developing layer 3 is subsequently transferred onto the desired material.

Examples of resins which may be used as the binder 4 include: water-soluble resins such as polyvinyl alcohol, methyl cellulose, ethyl cellulose, polyethylene oxide, hydroxyethyl cellulose, hydroxypropyl cellulose, pullulan, carboxymethyl-cellulose, polyvinyl-pyrrolidone, sodium polyacrylate, polyacrylamide, styrene-maleic anhydride copolymer, isobutylene-maleic anhydride copolymer, etc; and water-based emulsions such as acrylic resins, vinyl acetate resins, ethylene-vinyl acetate copolymer resins, etc. These resin materials may be used singly or in a suitable admixture. The resin binder 4 mainly functions as an adhesive when the developing layer 3 is transferred onto a desired material such as ordinary paper or cloth.

Any materials which are known to be usable as a developer for photo-pressure sensitive recording sheets may be used as the developer 5. Examples of suitable developers include: inorganic acid materials such as acid clay, active clay, kaolin, zeolite, bentonite, attapulgite, etc; compounds of the phenol series such as p-cresol, p-phenylphenol, p-chlorophenol, p-octyl phenol, 2,2-methylenebis (4-tert-butylphenol), a condensation product of phenol-formalin, a condensation product of phenol-acetylene, etc; compounds of the aromatic

carboxylic acid series such as salicyclic acid, 5-tert-butyl salicyclic acid, gallic acid, propyl tannic acid, p-butyl benzoic acid, p-hydroxybenzoic acid, 2,5-dihydroxybenzoic acid, etc; and metallic salts of the aromatic carboxylic acid series such as zinc salicylate, tin salicylate, zinc 2-hydroxynaphtoate, zinc 3,5-di-tert-butylate salicylate, etc; and metallic compounds such as ferric stearate, magnesium stearate, zinc stearate, etc. These developer materials may be used singly or in a suitable admixture.

The illustrated recording medium 1 is of the separate type, and in use is pressed together with a sheet carrying microcapsules having photo-sensitive, pressure-sensitive and/or heat-sensitive properties applied thereon and carrying a previously-formed latent image, so that the latent image is then developed. However, a recording medium according to the present invention may also be of the self-contained type, which can be achieved by providing microcapsules having photo-sensitive, pressure-sensitive and/or heat-sensitive properties also on the surface of the recording medium together with the thermally fusible and transferable developing layer 3.

Referring now to Figs. 2 to 4, each schematically illustrates the basic arrangement of a recording apparatus in which a recording medium according to the present invention can be used.

Fig. 2 illustrates a first embodiment of such a recording apparatus. In Fig. 2, a photo-pressure sensitive recording medium 11 coated with microcapsules containing photo-sensitive, that is, photo-setting resin, and a dye precursor, is fed in the direction of arrow A to an exposure system 10 where the photo-pressure sensitive recording medium 11 is exposed to light-carrying information from a light source (not shown), so that a latent image corresponding to the information carried by the light is formed on the recording medium 11

by selectively hardening the photo-setting resin of the microcapsules. The photo-pressure sensitive recording medium 11 carrying the latent image is then superposed on a recording medium 1 in accordance with this invention which is fed into the apparatus in the direction of arrow B, and the superposed recording medium 11 and recording medium 1 are passed between developing rolls 12 and 13 where they are pressed together so that the microcapsules which were not hardened at the exposure station 10 are selectively ruptured. In consequence, the thermally fusible and transferable developing layer 3 of the recording medium 1 and the microcapsules on the recording medium 11 are made to contact each other, so that the developing layer 3 reacts with the dye precursor exposed on the surface of the photo-pressure sensitive recording medium 11 from the selectively ruptured microcapsules, whereby the latent image carried by the recording medium 11 is developed on the recording medium 1 as shown by the hatching. The photo-pressure recording medium 11 after this pressure-development is taken up in the direction of arrow C by a take-up device (not shown).

The recording medium 1 carrying the thus-developed thermally fusible and transferable developing layer 3 is then superposed on, for instance, ordinary paper or cloth 16 which is fed in the direction of arrow D, and the superposed recording medium 1 and substrate material 16 are passed between heating rolls 14 and 15 so as to be heated and pressed. As a result, the developed thermally fusible and transferable developing layer 3 is heat-transferred onto the substrate 16. The support 2 of the recording medium 1 is taken up in the direction of arrow E by a take-up device (not shown), whilst the substrate 16 onto which the developed image of the developing layer 3 has now been transferred is fed in the direction of arrow F.

Fig. 3 shows another embodiment of recording apparatus, in which a recording medium 1 in accordance with this invention and having a thermally fusible and transferable developing layer 3 is fed in the direction of arrow A' and superposed on a substrate 26 eg of ordinary paper or which is fed in the direction of arrow B'. The superposed layers are passed between a pair of heating rollers 24 and 25 so that the thermally fusible and transferable developing layer 3 is heat-transferred onto the surface of the substrate 26. Next, the developing layer 3, now carried on the substrate 26, is superposed on a photo-pressure sensitive recording sheet 21 which has been exposed to image-carrying light by passage through an exposure system 20 to form a latent image thereon, and the superposed layers are passed between a pair of pressing rolls 22 and 23 so that the latent image is developed by the thermally fusible and transferable developing layer 3 on the substrate 26 so as to form a visible image on the substrate 26.

The substrate 26 which now carries the developed image 3' is then taken up in the direction of arrow C', whilst the used recording sheet 21 is separately taken up in the direction of arrow D'. Thus there is produced a substrate 26, eg of ordinary paper or cloth, onto which it appears that the image has been photo-pressure sensitively recorded.

Fig. 4 shows a basic arrangement of a developing and transferring apparatus in which a recording medium 31 in accordance with this invention of the self-contained type may be used. The recording medium 31 of the self-contained type has a support coated with not only a thermally fusible and transferable developing layer 3 but also a layer of microcapsules having photo-sensitive, pressure-sensitive and/or heat-sensitive properties. In the apparatus, a latent image corresponding to information carried by exposure light is

formed on the recording medium 31 through an exposure system 30. The latent image is developed by a pair of pressing and developing rolls 32 and 33. Then, the developed image is transferred by a pair of heating rolls 34 and 35 onto ordinary paper or cloth 36, for instance, which is the final recording sheet. The ordinary paper or cloth 36 having the developed image is taken up in the direction of arrow A" and the used recording medium 31 is taken up in the direction of an arrow B".

It will be apparent that the present invention permits desired information, for example letters, characters, pictures, or the like, to be recorded onto ordinary paper or specially treated paper to produce, for example official postcards, personal letter paper, forms, or the like; or onto articles of cloth such as shirts, training shirts, handkerchiefs, or the like. The recording can be made in desired colours by suitable selection of the microcapsules and the developer, and therefore desired multi-colour recording can be made on ordinary paper or cloth.

CLAIMS:

1. A recording medium comprising a support carrying a thermally fusible and transferable developing layer including a developer adapted to react with a dye precursor released from microcapsules to develop a colour.

2. A recording medium according to Claim 1, in which microcapsules containing said dye precursor are also provided on said support.

3. A recording medium according to Claim 1, wherein said support does not carry microcapsules containing said dye precursor, and wherein there is provided a separate recording medium comprising a support carrying microcapsules containing said dye precursor.

4. A recording medium according to any preceding claim, in which said support is formed of a material selected from plastics films which have a heat resisting temperature not lower than 150°C and paper.

5. A recording medium according to any preceding claim, in which said thermally fusible and transferable developing layer includes a relatively high melting resin binder and a low melting material in addition to said developer, said developer and said low melting material being dispersed in said resin bind such that said developer is not mixed with said low melting material.

6. A recording medium according to Claim 5, in which said low melting material includes at least one material selected from: wax-like materials and low-melting thermoplastic resins.

7. A recording medium according to Claim 5 or Claim 6, in which said resin binder is at least one material selected from water-soluble resins and water emulsions.

8. A recording medium according to any preceding claim, in which said developer includes at least one material selected from: an inorganic acid material; a compound of the phenol series; a compound of the aromatic carboxylic acid series; a metallic salt of an aromatic carboxylic acid; and a metallic stearate.

9. A method of forming an image on a substrate, which comprises the steps:

(a) providing a recording medium as claimed in Claim 2,

(b) forming a latent image on said recording medium by exposing said microcapsules to information-bearing radiation, and

(c) in either order, effecting heat-transfer of said developing layer onto a substrate and developing the latent image by application of pressure to said developing layer.

10. A method of forming an image on a substrate, which comprises the steps:

(a) providing two separate recording media as claimed in Claim 3,

(b) forming a latent image on said recording medium carrying said microcapsules by exposing said microcapsules to information-bearing radiation, and

(c) in either order, effecting heat-transfer of said developing layer onto a substrate and bringing said developing layer and said microcapsules into contact under pressure whereby said latent image is developed.

11. A recording medium substantially as hereinbefore described with reference to Fig. 1 of the accompanying drawings.

12. The use of a recording medium according to any preceding claim to form a developed image on a paper or cloth substrate.

13. The use of a recording medium to form a developed image on a substrate, substantially as hereinbefore described with reference to Fig. 2, Fig. 3 or Fig. 4 of the accompanying drawings.

Published 1988 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office